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Published in:
Book of Abstracts, Sustain 2017

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

Sustainable solar fuels and electricity through discovery and prototyping of new materials

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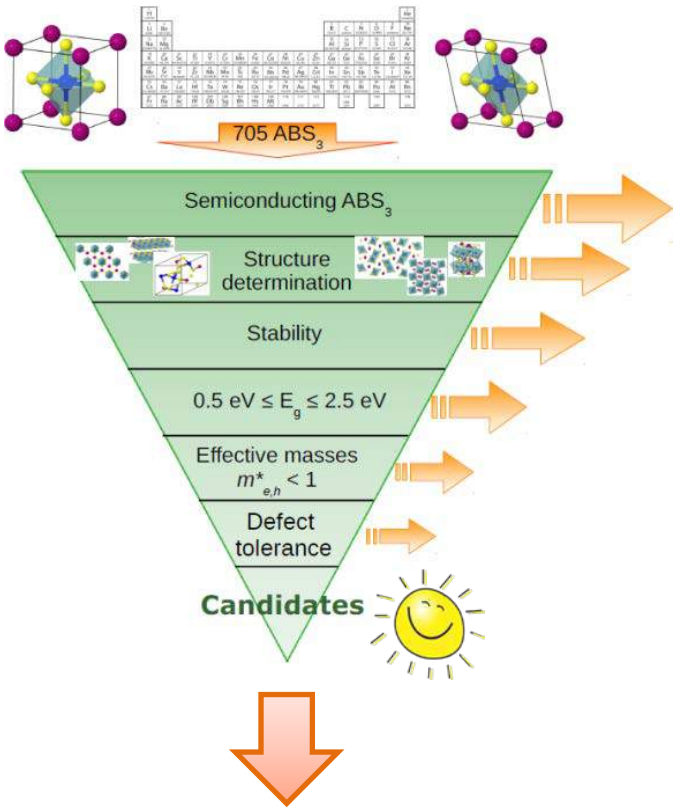
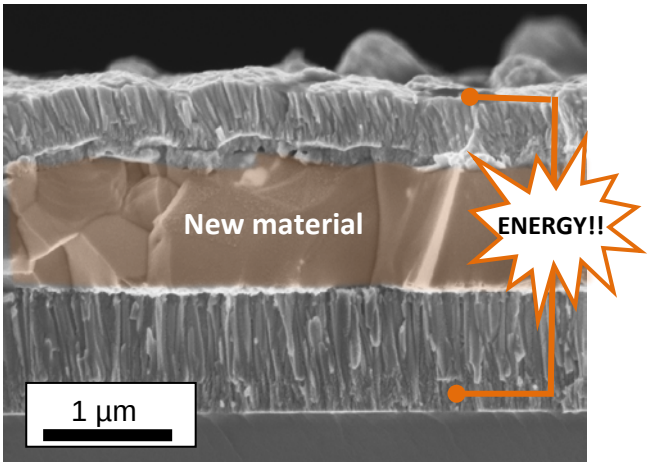
In 2016, only 20% of the electricity produced in the world did not result in direct emission of harmful gases into the atmosphere. If one excludes hydropower, that percentage further drops to 5%. In the same year, the percentage of fuels that did not emit harmful gases upon use or production was nearly zero.[1]

Nevertheless, the solar radiation power received at any instant by a very small fraction of the Earth would be sufficient to satisfy the world's electricity and fuel demand. Apart from electricity generation through the well-known solar cells, it is also possible to produce fuels (e.g. hydrogen) by splitting water electrochemically through solar energy.[2] Future improvement in conversion efficiency and reduction of costs calls for new materials with tailored properties.

At DTU Physics, a joint effort by computational- and experimental material scientists has resulted in massive computational screening of potential new materials for solar electricity and solar fuels. Tailored photo-absorber materials based on earth-abundant elements have been discovered, synthesized, and inserted into prototype devices. We will tell the story of the most successful material produced so far, from its speculated existence as one among many screened candidates, to its experimental "birth" in the real world and towards its maturity as an active material in solar devices.





[1] Renewables 2016 Global Status Report, http://www.ren21.net/wp-content/uploads/2016/06/GSR_2016_Full_Report.pdf
[2] J.W. Ager, M.R. Shaner, K.A. Walczak, I.D. Sharp, and S. Ardo, Energy Environ. Sci. **8**, 2811 (2015).